REVIEW OF A SELECTION OF URBAN SAFETY AUDITS

Review and Audit Division
Report No. 95/416S

Report No. 95/416S AU1-0021

REVIEW OF A SELECTION OF URBAN SAFETY AUDITS

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Transfund New Zealand
July 1996

DISCLAIMER

This is a final report A draft has been reviewed by a peer group It has been modified to take account of the comments of that group.

This report contains the findings, opinions and recommendations of the reviewer based on an examination of a sample of audit reports only. As a consequence the review may not identify all features of all audit reports

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Note *This review was commenced prior to the establishment of Transfund New Zealand consequent upon the Transit New Zealand Amendment Act 1995, which came into effect on 1 July 1996*

REVIEW OF A SELECTION OF URBAN SAFETY AUDITS

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M L Gadd

1. INTRODUCTION

This project has set out to review a selection of urban - mainly intersection - safety audits mostly initiated by Transit New Zealand

It is now two years since Transit New Zealand published "Safety Audit Policy and Procedures" and the Safety Audit Manger, Dr Ian Appleton has proposed that a selection of urban, and a selection of rural safety audits be studied to determine the frequency with which topics arose so as to alert designers of the need for care in these areas

Altogether thirty five urban safety audits were analysed and reviewed They range from brief reports making three or four recommendations to much larger audits containing up to sixty comments The table below sets out the total number reviewed in each stage as defined in the TNZ publication

Stage 1 or Feasibility	5
Stage 2 - Project Assessment	3
Stage 3 - Final Design	8
Stage 4 pre-opening	15
Stage 5 - post construction	3
Not Stated (existing on site?)	2
TOTAL	36

Table 1 - Stages of safety audit reports reviewed

Note One scheme had both stage one and stage 2 safety audits carried out The two "not stated" reports were substantiality of existing on-site conditions

It is apparent from the table that much of the subject matter concerned actual or on-street conditions, as might be expected from the predominance of stage 4 safety audits Many of the exercises were pilot audits aimed at not only looking at projects but also training potential safety auditors so as to rapidly spread the techniques

It is not intended to discuss individual reports, or sites, or members of teams, though much of that information is essential background information for a proper and full analysis A condensed version of each report and a master list of the reports analysed, together with the number of occasions a topic was raised, is included in the accompanying volume not for general distribution "(2) Topic assignment and Master List"

At the outset of the project it was decided to include as large a sample as practicable to ensure adequate representation of some of the earlier stages and to give confidence in the findings

1.1. Project objectives

The project has developed as the pile of reports were scutinised and analysed The brief called for an analysis of safety audits to determine the frequency of topics encountered and a summary of which stages were audited As these objectives involved reading and categorising each report the opportunity was taken to look at other aspects of safety audit The following objectives emerged

(a) To study the topics raised and report on the frequency with which topics were included in the reports (The main objective of the brief)

(b) To see how far the individual comments fitted in to the guidelines topics included in the TNZ Safety Audit Policy and Procedures, August 1993,

(c) To determine how the procedures had been followed , and any significant difficulties which were apparent

(d) To discover any "problems" that did not fit in with the categories or topics, and if appropriate suggest additions or improvements

(e) To determine how effective and useful the policy had been in practice

(f) To comment on the "style" of reporting and make observations on the readability, impact and usefulness of different approaches

(g) To make suggestions as to how the policy and practice might be improved, both in essence and detail These ideas are essentially for discussion only and are principally to spark discussion if and when the Safety Audit Manager considers they are worthwhile pursuing As is the practice in safety audits I will express each comment as "***Consider etc*** "

It is intended that a summary of important topics and other relevant information will be published in a short report and/or made available to designers, safety auditors and other interested people

The effectiveness of safety audit is reflected firstly in the acceptance of comments be safety auditors, and in changes to the plans and on the roads themselves It is possible to find out more about the first of these topics (and this is discussed later), no easy mechanism exists for the second With the acumulation of data no doubt the effdectiveness of safety audit as an accident reducing policy will be tested

2 METHODOLOGY

(a) It was decided to express the information in each safety audit in a form which could be analysed and comparisons be made between reports A spreadsheet was developed with the essential facts about where each study was undertaken, who took part, what stage the study was addressing, what was found and what was recommended This information is included in a separate report

(b) This process ensured that each report had to be read in some detail Some quick impressions were jotted down at the foot of each information sheet

(c) The safety audits studied represented all stages from (1) feasibility to (5) post construction The Concise checklist for stages one to four was adopted from the Policy and Procedures (reproduced in the appendix to this report) With the exception of Stage 1 - Feasibility - the lists have much in common, with topics being added or dropped moving from stage 2 to stage 4 To make the task a little easier it was decided to produce one common list and assign topics to appropriate items This may seem to be an unjustifiable generalisation but the lists are - by general agreement - no more than auditor's aids (a contagious but benign condition) Recent comments from respected authorities such as Barbara Sabey make clear the view that not too much time should be spent on refining checklists

What looked at the outset like being a useful, logical, engineering style system, was proving to have an almost minor role Some analysis might reveal the reason for this or throw up possibilities of improvement or making the list more useful

(d) A spreadsheet was prepared with a matrix expressing the locality of the safety audits v the topics (in the general list plus a few additions as explained later), with the actual number being entered into the chart

(e) These data were further analysed by chart to provide information about the frequency with which each topic was mentioned

(f) As a matter of minor interest the range of numbers of problems per audit has also been represented graphically

(g) The range and average size of teams was also determined

3 ANALYSIS AND SUMMARY OF REPORTS

3.1 The checklists - usefulness, relevance, little used topics

It is apparent that the checklists form no more than an aid to the process of safety audit Some auditors included copies of the checklist appropriate to the stage being audited and ticked or crossed each topic Some attempted to use the order of the checklists in presenting the report (I believe Phillip Jordan adopted this style) Possibly one common approach was to look at the plans and the site to get a general feel for the job and at a later stage go through the checklist to see if anything had been missed out

Some items were raised which do nor fit easily into any of the topics listed in the checklists, sometimes the problem or comment could be entered into more than one topic heading There seems to be no reason why the checklists could not be improved by the addition of missing topics or the wording changed to make the meaning clearer

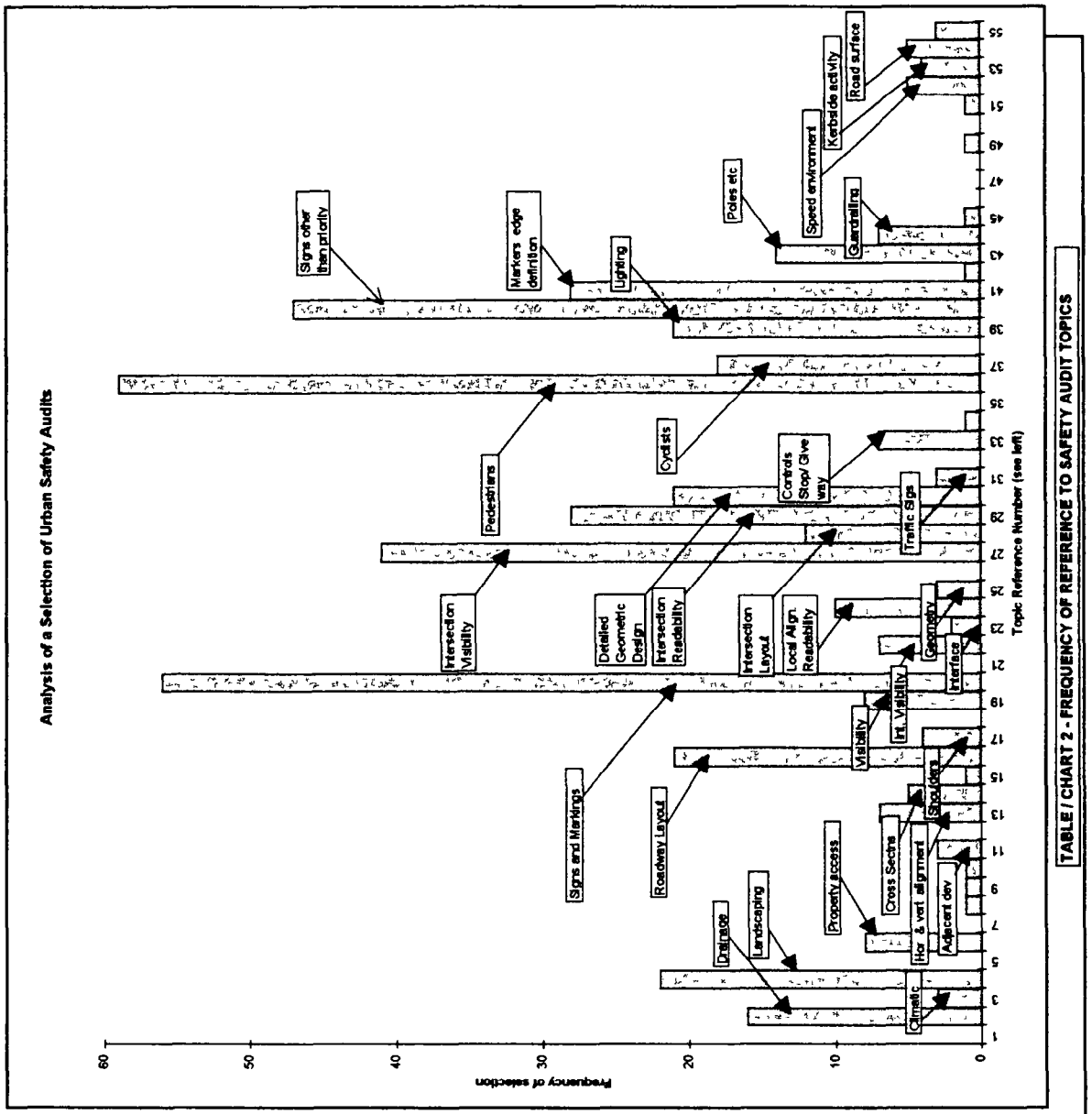

TABLE / CHART 2 - FREQUENCY OF REFERENCE TO SAFETY AUDIT TOPICS

Main Heading	Topic reference, Description	Ref	Freq
G1a General Topics	1 Changes since previous Stage	1	0
	2 Drainage	2	16
	3 Climatic Conditions	3	3
	4 Landscaping	4	22
	5 Services	5	0
	6 Access to Property and Development	6	8
	7 Emergency vehicles and access	7	0
	8 Future widening &/or realignment	8	1
	9 Staging of scheme	9	1
	10 Staging of works	10	1
	11 Significant adjacent developments	11	3
	12 Batter stability - surface effects	12	0
G1b Design Approach	13 Geometry of Hor & Vert Alignments	13	7
	14 Typical Cross Sections	14	5
	15 Effect of cross sectional variation	15	1
	16 Roadway Layout	16	21
	17 Shoulders, edge treatment	17	4
	18 Departure from standards & guidelines	18	0
	19 Visibility, sight distances	19	8
	20 Signs and markings	20	56
	21 Traffic calming devices	21	0
G2 Local Alignment	1 Visibility	22	7
	2 New/Existing Road Interface	23	2
	3 Readability by drivers	24	10
	4 Detailed Geometric Design	25	3
	5 Treatment bridges & Culverts	26	0
G3 Intersections	1 Visibility	27	41
	2 Layout, appropriateness	28	12
	3 Readability by drivers	29	28
	4 Detailed geometric design	30	21
	5 Traffic signals	31	3
	6 Roundabouts, islands	32	0
	6a Controls - Stop / Give Way	33	7
	7 Other Intersections	34	1
G4 Non-vehicular	1 Adjacent Land	35	0
	2 Pedestrians	36	59
	3 Cyclists	37	18
	4 Equestrians/stock	38	0
G5 Signs & Lighting	1 Lighting	39	21
	2 Signs other than priority	40	47
	3 Markers edge delineation	41	28
G6 Physical Objects	1 Median barriers	42	1
	2 Poles & other obstructions	43	14
	3 Guardrailing	44	7
	4 Bridge & culvert parapets	45	1
	4a Kerbs, other hard objects wrongly sited	46	0
Operation	1 Buildability	47	0
	2 Operation	48	0
	3 Traffic Management	49	1
	4 Network Management	50	0
	5 Temporary traffic control / management	51	1
G8 Any other matter	1 Speed environment	52	5
	2 Parking, kerbside activity (bus stops etc)	53	4
	3 Road surface metal, paint, skidding	54	5
	4 Other matters	55	3

However, in analysing a variety of styles and lengths of report, it is clear that one of the few logical methods of comparison (as opposed to writing long dissertations about each) is to assign each ****Problem**** (also simple "problems" or comments - since not all auditors used the four-star approach) to a topic on a checklist and add up the frequency each topic is selected The results are expressed in Table 2/figure 1 on the previous page

However, before discussing this chart, the process of arriving at the form and content offers some useful pointers

For instance, one difficulty was found in assigning topics The lists are not entirely logical for this purpose, many topics appearing in the "1a" and "1b" and later on in the list This was not entirely due to the production of one list, though logically there seems no reason why one extended list with appropriate headings should not work, perhaps be more attractive to auditors than the present multi-list approach

> ***Consider the idea of one all-inclusive list rather than the present system of have separate lists, often having largely common topics. Consider also remedying deficiencies and grouping topics in a different way.***

Difficulty was also experienced in deciding where to slot each problem Many of the studies (approximately two thirds) were concerned with existing shortcomings on the road or intersection This is encouraging from the point of view that audits of existing networks should have value in identifying problems and proposing remedial action - without waiting for the accident rate at any location to flag the location as a problem ("black spot")

However, this aspect was not the main concern (certainly not the authors) in drawing up the present checklist topics In addition, four topics appear to have been omitted or glossed over -

(a) **Priority controls** as a separate topic (ie not included in the all-embracing "signs") The appropriate selection and placing of priority signs has a different connotation from information or street name signs

(b) The **"speed environment"** seems important I have been unable to locate a mention of speed in other than Stage 1 - Feasibility As many audits are of designs which have never been through a stage 1 audit, and even if they had, the actual translation of speed into practice (and at the transition to existing network) is an important matter This is particularly so since most of the audits dealt with the "built" traffic environment

(c) **Kerbside activity** seems to be a neglected topic in the lists - not entirely, but with the emphasis on the site conditions, it seems worthy of more than a passing mention The presence of old or badly sited kerbs is also worth mentioning

(d) The **road surface** was a topic occasionally mentioned The lists, based as they largely are on the idea of auditing proposals rather than existing conditions, do not feature any significant mention The topic can include changes in level, large areas

of (slippery) paint, upstanding service boxes, old kerbs, as well as the condition of the surface (eg slick with bleeding bitumen, or even ordinary bitumen)

Consider amending the lists - particularly of the later stages - to include the above topics.

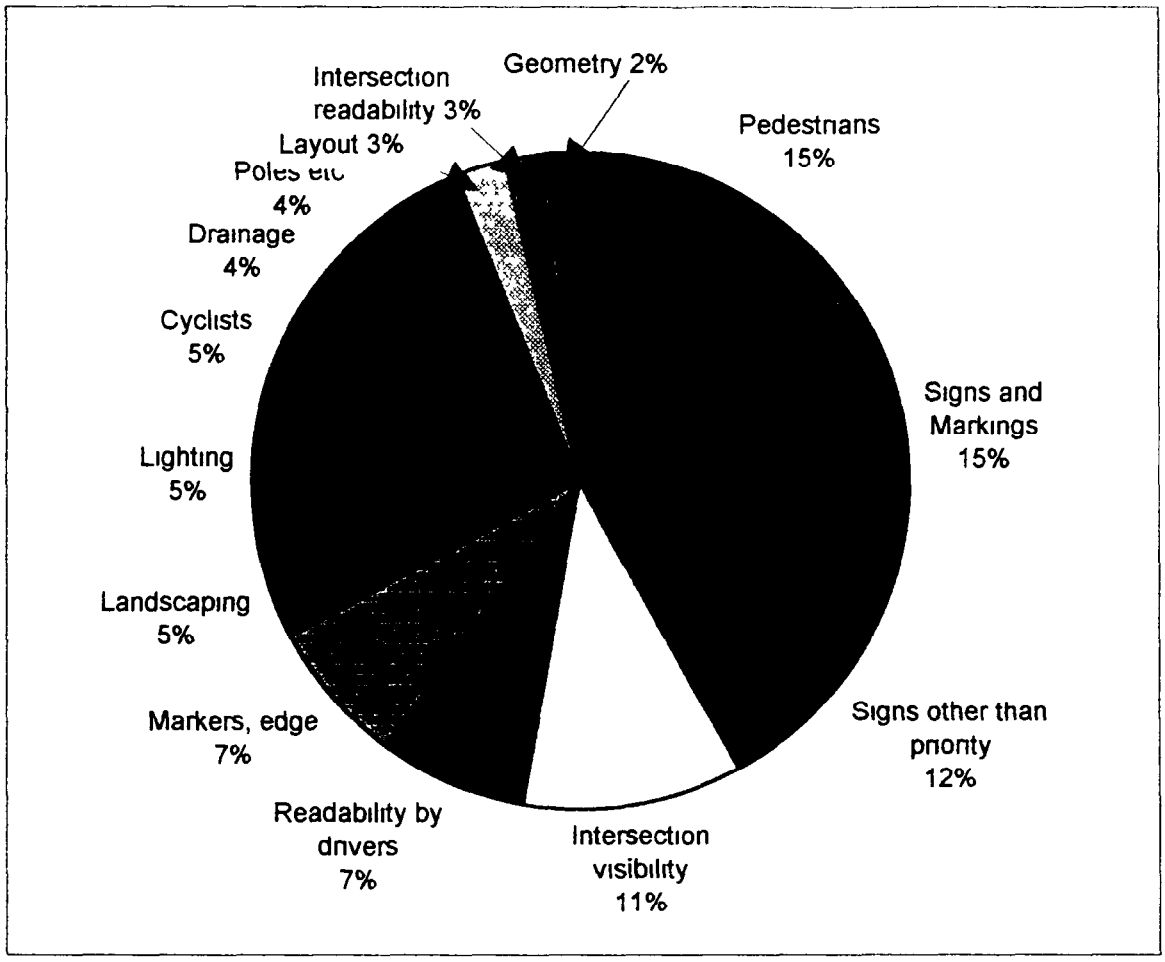

Figure 2 - Split of safety audit subjects between selected topics

I also became acutely aware that the checklists are a mixture of local conditions, traffic engineering, and travel modes Possibly this is a natural outcome of considering cyclists and pedestrians as being a sort of "add on" to the main aim of dealing with vehicular traffic This approach is not, in my opinion justified, and one way of dealing with the presentation of the checklists is to separate all vehicular types out of the main list - including "general traffic"

These matters will be covered in greater detail later in the report The logical step, before analysing the frequency, was to add the missing topics to the present general checklist Figure 2 (above) illustrates this in diagramatic form

3.2 The frequency of reference to topics

The chart (Figure 2) on page 5 and table (3) on page 6 convey the strong popularity of topics such as pedestrian safety, signs and markings and readability and the complete neglect of others Out of the fifty or so possible topics this represents a limited number but is a not altogether a surprising result It has to be pointed out that the topics are open to different interpretation and a different person scanning the reports might place the emphasis elsewhere in a few cases For instance I tended to neglect "Traffic management" as being too broad when more detailed and precise slots were available "Buildability", "Operation" are similarly too vague (apparently) "Non vehicular adjacent land" concerns seem covered in "significant adjacent developments" (and only three uses, interestingly headed as such)

The lack of use of some items like emergency vehicles, bridges and culverts etc does not mean that these topics are redundant, they will have their time and place

For ease of reference, here is a table of the more significant topics (as per table/figure 1) -

Ref	Topic description	Number of refs
36 (G4/2)	Pedestrians	59
20 (G1b/20)	Signs and Markings	56
40 (G5/2)	Signs other than priority	47
27 (G2/1)	Intersection visibility	41
29 (G3/3)	Readability by drivers	28
41 G5/3)	Markers, edge definition	28
4 (G1a/4)	Landscaping	21
39 (G5/1)	Lighting	21
37 (G4/3)	Cyclists	18
2 (G1a/2)	Drainage	16
43 (G6/2)	Poles and other obstructions	14
28 (G3/2)	Layout	12
24 (G3/3)	Intersections Readability	10
13 (G1b/13)	Geometry, hor and vert alignment	7
22 (G2/1)	Local alignment visibility	7

Table 3 - The topics most referred to in the sample

The most "popular" topics are to do with movement types and the layout of the road Many of the balance are collectively to do with vision, a clear unobstructed view of a readable road or intersection Faults with the road as found are included if they are are real safety worries Some of the specific items mentioned in audits are somewhat distant from safety, but the auditors can be excused as they wish to

point out general faults, including things that are OK now but might go wrong in future

The main use of the list is to impress on scheme designers, traffic engineers and others the priority of aspects of roads and intersection which are unsatisfactory and potentially accident promoting Unfortunately, with three exceptions (where reports were included with the safety audit), it has not been possible to quantify or discuss the reactions of the designer and client, still less to observe resultant changes on-street

The publication of a general list such as the one in table 2 could be of wide interest to both designers and the safety auditors group, and may help to influence areas being targeted for safety reasons The publication of this table and discussion at a traffic workshop is one way to go about drawing attention to these matters to the group, and could foster a general discussion at that time

It may be useful in helping an appreciation of the broad issues to allocate topics to larger groups of common purpose, as mentioned above These may be termed Physical or general items (involving the road, solid objects), Visibility, and road users

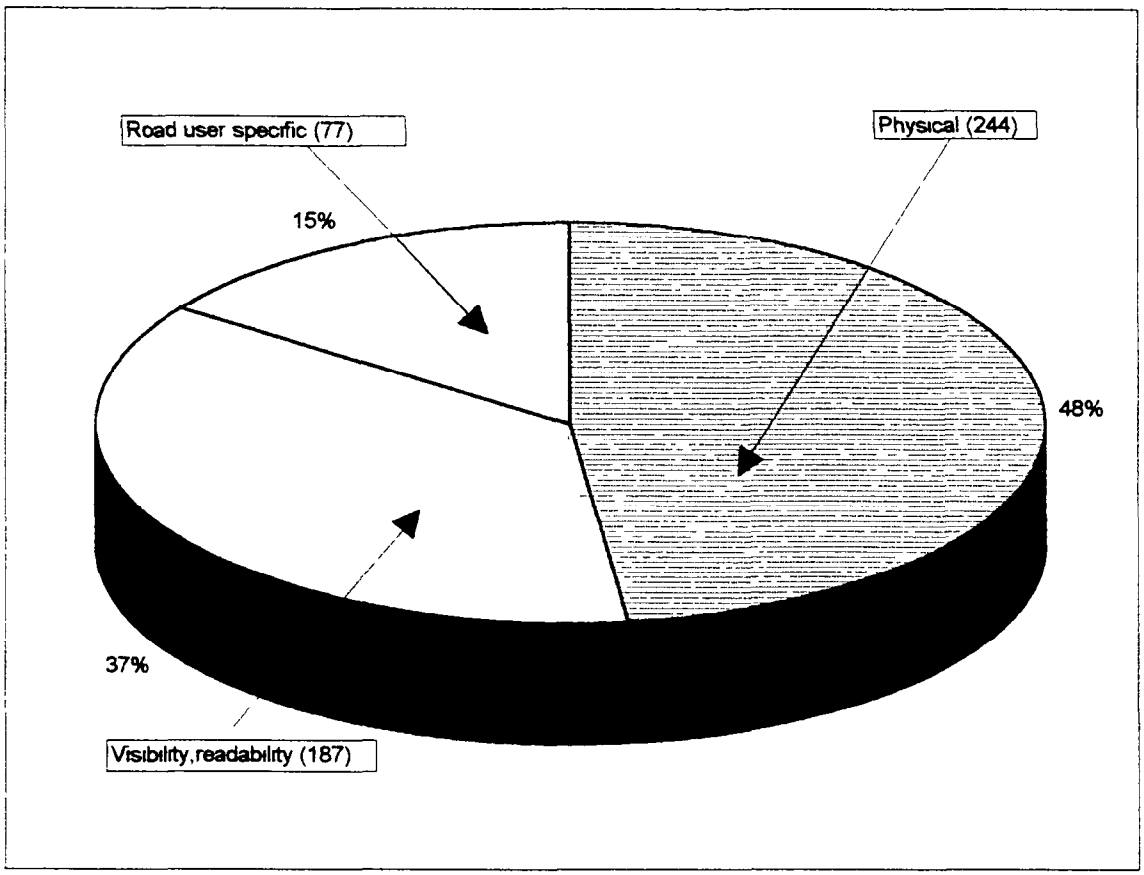

Figure 3 - Allocation of topics to three basic types

MAIN HEADING	Topic reference Description	Ref	requenc	Physical General	Visibility, readability	Road user	Total % of main heading
G1a General Topics	1 Changes since previous Stage	1	0				
	2 Drainage	2	16	16			
	3 Climatic Conditions	3	3	3			
	4 Landscaping	4	22	11	11		
	5 Services	5	0				
	6 Access to Property and Development	6	8	8			55/11%
	7 Emergency vehicles and access	7	0				
	8 Future widening &/or realignment	8	1	1			
	9 Staging of scheme	9	1	1			
	10 Staging of works	10	1	1			
	11 Significant adjacent developments	11	3	3			
	12 Batter stability - surface effects	12	0				
G1b Design Approach	13 Geometry of Hor & Vert Alignments	13	7	7			
	14 Typical Cross Sections	14	5	5			
	15 Effect of cross sectional variation	15	1	1			
	16 Roadway Layout	16	21	21			
	17 Shoulders, edge treatment	17	4	4			102/20%
	18 Departure from standards & guidelines	18	0				
	19 Visibility, sight distances	19	8		8		
	20 Signs and markings	20	56	28	28		
	21 traffic calming devices	21	0				
G2 Local alignment	1 Visibility	22	7		7		
	2 New/Existing Road Interface	23	2	2			
	3 Readability by drivers	24	10		10		
	4 Detailed Geometric Design	25	3	3			22/4%
	5 Treatment - bridges & Culverts	26	0				
G3 Intersections	1 Visibility	27	41		41		
	2 Layout, appropriateness	28	12	6	6		
	3 Readability by drivers	29	28		28		
	4 Detailed geometric design	30	21	11	10		
	5 Traffic signals	31	3	3			113/22%
	6 Roundabouts, islands	32	0				
	6a Controls - Stop / Give Way	33	7	7			
	7 Other intersections	34	1	1			
Non-vehicular	1 Adjacent Land	35	0				
	2 Pedestrians	36	59			59	
	3 Cyclists	37	18			18	77/15%
	4 Equestrians/stock	38	0				
G5 Signs and lighting	1 Lighting	39	21		21		
	2 Signs other than priority	40	47	47			96/19%
	3 Markers edge delineation	41	28	14	14		
G6 Physical objects	1 Median barriers	42	1	1			
	2 Poles & other obstructions	43	14	14			
	3 Guardrailing	44	7	7			
	4 Bridge & culvert parapets	45	1	1			23/5%
	4a Kerbs other hard objects wrongly sited	46	0				
G7 Construction & operation	1 Buildability	47	0				
	2 Operation	48	0				
	3 Traffic Management	49	1	1			2/0%
	4 Network Management	50	0				
	5 Temporary traffic control / management	51	1	1			
G8 Any other matter	1 Speed environment	52	5	3	2		
	2 Parking, kerbside activity (bus stops etc)	53	4	4			17/3%
	3 Road surface metal paint skidding	54	5	5			
	4 Other matters	55	3	3			
	TOTALS		507	244	186	77	507
	PERCENTAGE		100	48	37	15	C 100

Table 4 - Allocation of "problems" to topics, and to three basic types

In Figure 3 and table 4, on the previous pages, each topic was allocated to a generic group, as already mentioned Where topics appeared to fit two groups approximately equally well, the total references to that topic were divided equally between the two The pie chart in Figure 3 above, illustrates the dominance of the physical and visibility/readability groups The other group -the users - at 15% seems to belong to a different field

As requested in the brief it is suggested that this information and other aspects of this review be distributed to road designers, safety auditors and others who have a role in safety audit so that special attention can be paid to the most common design shortcomings.

4. COMMENTS ON SAFETY AUDITS

It is with some trepidation that I voice opinions about the examples reviewed, and there are no personal or identifiable comments intended, though some may recognise the aspect as being present in their own report

Firstly, there are no "bad" reports, the standard of expression seems high and easy to follow There are, however, styles and presentations - and occasionally omissions - that make the reports less easy to follow and therefore less effective

4.1 Style and presentation

Firstly the broad style An example is provided in the Policy and Procedure manual A few followed it literally, some had their own version, many did not even express a gradation of problems I personally have some difficulty in the use of *****Problem***** (or ******Problem*****, or ****Problem****). I agree that a gradation of problem will need to be described However, not all reports make use of this style, and some of those that do simply put *****PROBLEM***** and put the topic at the top of the first paragraph, so that it is necessary to read the report to find out what is the problem I believe that three degrees of seriousness will do the job -

SERIOUS PROBLEM:** (followed by location and essence)

PROBLEM (as above) and

Comment:

(a) Consider reviewing heading/information style and suggesting safety auditors make clear the topic as part of the heading

Similarly the covers to reports and information on them vary The pilot audits seem the best, but still lack the stage of audit being carries out

(b) Consider requesting report writers to state on the front cover the Road or Intersection, its classification, who the report is by, for whom it is intended and what stage is being audited.

The preamble could well now be shortened but required to contain important information Very few audits gave the duration of the work A rare inclusion was a locality map, very useful to people reading the report, particularly if they are not familiar with the area, and where several safety audits are being or have been done in the locality helping to understand their spatial relationship

(c) Consider requesting safety auditors to include a locality or overall plan and providing information about the duration of the study, and any expansion of the data presented on the cover.

Without being dogmatic, it is useful to a reviewer to have a reasonably standard order, presentation style and degree of detail It would be over regimenting to make this mandatory, our concern would be to make for the greatest impact (and acceptance or clarity of reasons for rejection) A well set out, easy-to-read report goes a long way to achieving these fairly obvious goals

(d) Consider - particularly if the checklist is revised and abbreviated - providing a pro-forma order for reporting

On rare occasions a report of an area was difficult to follow, particularly if the order of topic is not related to either a pro-forma order, or a progression through the scheme from beginning to end

5. THE TEAMS - COMPOSITION AND OUTPUT

An attempt was made to analyse the composition of safety audit teams involved in the sample of 35, and any other useful facts that could be deduced (This was partly inspired by an article in the Highways and Transportation magazine, June 1995) It became apparent that the variability of reporting style and inclusion of information made it difficult to determine any factor other than the composition of the teams Here is a summary of facts that could be determined

Number	Frequency - in actual team	Frequency - under training	Report by TNZ	Report by Consultant	Report by Local Body Officer
1	1	1	17	11	4
2	11	8			
3	13	5			
4	6				
5	1				

Table 5 - Number of auditors and learners, who wrote the report

The average number of auditors per team was 2 7, with an average of 1 person attending for training purposes The last three columns are an attempt to determine which organisation was responsible for the actual report

6. AN OVERVIEW AND COMMENTS ON POSSIBLE CHANGES

In looking at checklists over many days, it struck me that the list or lists lack a logical basis in that they contain all items in a one dimensional list, so that development (planning) rubs shoulders with Poles and bridge abutments (fixed objects) and cycles and pedestrians (moving objects)

This is the point made in the discussion about allocating topics to the three groups - Physical, visibility, road user

Why not consider a different system where the table consisted solely of non-road user specific attributes, and a matrix created with the road users placed on one axis of this table rather than being mixed up in it

The result, with some other possible improvements is given in Table 3 The other "improvements" include

(a) abandoning the distinction between intersections and non intersections Many topics are shared in common, others are so specific that it is not necessary to explain that an intersection is involved - eg traffic signals, priority controls

(b) Using the heading "Objects which may be struck or limit design", and adding a few topics

(c) Using the heading "Assisting the road user - Signs and Lighting"

The changes are largely self-explanatory They are intended to simplify the checklist to the point where one list can be used for all stages (except possibly stage 1), and for that reason - and the addition of omitted topics and the logic of putting all movement types at the top - safety auditors may be keener on using the checklist

In any event, any discussion of this new way style of checklist will be helpful in focusing attention on the need or function of checklists in general

7. STAGE 1 FEASIBILITY

Only three safety audits related to this stage and appeared to deal with the issues very well The checklist appears to be satisfactory, and with only three sets of topics analysis seemed pointless However, the topic may justify further attention

At some future time it may be worthwhile checking to ensure that the topics mentioned are dealt with at stage two or three

TYPE OF MOVEMENT> / TOPICS LIST V	A GENERAL	B EMERGENCY VEHICLES	C HEAVY GOODS VEHICLES	D BUSES	E LIGHT TRADE AND CARS	F MOTORCYCLES	G KERBSIDE VEHICLE USE	H CYCLES	I PEDESTRIANS (a) GENERAL	J (b) MOBILITY IMPAIRED	K EQUESTRIANS	L STOCK ANIMALS
1a. Issues and general conditions												
1 Changes since previous stages												
2 Drainage												
3 Climatic conditions												
4 Landscaping general												
5 Services - buried and overhead												
6 Access to property and development												
7 Future widening &/or realignments												
8 Staging of scheme												
9 Staging of works												
10 Significant adjacent developments												
11 Batter stability - surface effects												
1b General or Scheme Design approach												
13 Geometry of horizontal and vertical alignment												
14 Appropriateness of design speed adopted												
15 Typical cross sections adequacy												
16 Effect of Cross Sectional Variation												
17 Roadway layout for traffic management												
18 Shoulders edge treatment												
19 Effect of Departure from Standards and Guidelines												
20 Visibility, sight distances												
21 Signs and markings												
22 Surface skid resistance												
23 Contrast with markings												
24 Installed hazards												
25 Natural features												
2 Local Alignment including Intersections												
1 Visibility												
2 Readability by drivers and other road users												
3 Correctness of speed design												
4 New/existing road interface												
5 Relationship to other nearby intersections												
6 Layout, geometric design including pavement markings												
7 Traffic signals												
8 Stop and give way signs												
9 Roundabouts islands pedestrian refuges												
10 Traffic restraints traffic calming (all road types)												
3 Objects which could be struck or limit design												
1 Median barriers												
2 Poles & similar obstructions												
3 Guardrailing (vehicle or pedestrian)												
4 Bridge & culvert parapets underpass soffits												
5 Solid Vegetation												
6 Verandahs												
4 Assisting the Road User -Signs and Lighting												
1 Lighting												
2 Traffic Signs - position and appropriateness size												
2 Other Signs - including distractive (non-road) signs												
3 Markers edge delineation												
5 Construction and operation												
1 Buildability												
2 Operation												
3 Traffic Management												
4 Network Management												
5 Temporary traffic control / Management												
6 By-law requirements (P)												
66 Safety aspects not already covered												

Table 6 - A different way of constructing a safety audit checklist

8. SUMMARY OF MAIN POINTS AND SUGGESTIONS

8.1 Publish the list of topics raised to increase awareness amongst designers and others

As requested in the brief, it is suggested that this information and other aspects of this review be distributed to road designers, safety auditors and others who have a role in safety audit so that special attention can be paid to the most common design shortcomings.

8.2 One checklist for all stages

Consider the idea of one all-inclusive list rather than the present system of have separate lists, often having largely common topics. Consider also remedying deficiencies and grouping topics in a different way.

8.3 Additional Topics

Consider amending the lists - particularly of the later stages - to include the topics: priority controls, speed environment, Kerbside activity and controls, surface of the road (condition)

8.4 Review presentation of information about each point to make importance clearer

Consider reviewing heading/information style and suggesting safety auditors make clear the topic as part of the heading of each "problem" or comment.

SERIOUS PROBLEM** (followed by location and essence) or
PROBLEM (as above) and
Comment

8.5 Front Cover Information

Consider requesting report writers to state on the front cover the Road or Intersection, its classification, who the report is by, for whom it is intended and what stage is being audited.

8.6 Locality Plan and additional information in introductory paragraph

Consider requesting safety auditors to include a locality or overall plan and providing information about the duration of the study, and any expansion of the data presented on the cover.

8.7 Use pro-forma order for reporting

Consider - particularly if the checklist is revised and abbreviated - providing a pro-forma order for reporting

8.8 A possible different style of checklist

Consider a different system where the table consisted solely of non-road user specific attributes, and a matrix created with the road users placed on one axis of this table rather than being mixed up in it.

8.9 Other possible additions and modifications

Consider:

(a) abandoning the distinction between intersections and non intersections. Many topics are shared in common; others are so specific that it is not necessary to explain that an intersection is involved - eg. traffic signals, priority controls.

(b) Using the heading "Objects which may be struck or limit design", and adding a few topics

(c) Using the heading "Assisting the road user - Signs and Lighting"

9. CONCLUSION

The study has highlighted the most common "problems" which could be addressed by road designers Signs and marking collectively appear to be two of the most common topics Pedestrians are the number one "problem" ie the possibly needless risk they face through shortcomings in the design Many of the balance are to do with visibility or readability Almost half of the topics were related to the physical road environment, approximately a third to do with visibility or readability and the balance related to specific vehicle movements

As this report is an analysis of only a few aspects of the safety audits carried out, it would be presumptuous to suggest that radical changes should be made to the form and practice However, there are changes to the report style or layout which would assist the understanding of each report and how it compares with others

This would also assist if at any time in the future, an evaluation were to be carried out as to the cost effectiveness of the process, and how effective it is in firstly, persuading designers to change their plans, secondly, whether the accident rate has been reduced either at individual site or en masse (at schemes which have been safety audited) I suggest that consideration be given to defining and setting up such a project

The inclusion or omission of any item covered in the list of considerations is a matter for the Safety Audit Manager to decide The suggestions made in the report and summarised above seem worth looking at if and when changes to the procedures are made Possibly a session of a representative group of designers and safety auditors could discuss them and/or the approved topics could be aired at the forthcoming 27th Traffic Management Workshop

APPENDIX -MASTER CHECK LIST - ALL STAGES M

STAGE 1 FEASIBILITY ('F')		STAGE 2 - PROJECT ASSESSMENT (P)		STAGE 3 FINAL DESIGN ('D)		STAGE 4 PRE-OPENING (O)	
F1a General Topics 1 Scope of Project function traffic mix 2 Type and degree of Access to Property and Developments 3 Significant adjacent Developments 4 Influence of staging 5 Future widening &/or Realignments 6 Wider Network effects		P1a General Topics 1 Changes since Stage 1 2 Drainage 3 Climatic Conditions 4 Landscaping 5 Services 6 Access to Property and Development 7 Emergency vehicles and Access 8 Future widening &/or Realignments 9 Staging of scheme 10 Staging of works 11 Significant adjacent Developments 12 Stability of cut & fill surface effects		D1a General Topics 1 Changes since Stage 2 2 Drainage 3 Climatic Conditions 4 Landscaping 5 Services 6 Access to Property and Development 7 Emergency vehicles and Access 8 Future widening &/or Realignments 9 Staging of scheme 10 Staging of works 11 Significant adjacent Developments 12 Batter stability surface effects		O1 General Topics 1 Changes since Stage 3 & Translation of Design 2 Drainage 3 Climatic Conditions 4 Landscaping 5 Services 6 Access to Property 7 Emergency vehicles & Access 11 Significant adjacent Developments 12 Batter Treatment 17 Shoulders & edge delin 20 Signs and markings 21 Surface skid resistance 22 Contrast with markings 23 Installed hazards 24 Natural features	
F1b Design Approach 7 Route Choice 8 Impact of continuity with existing network 9 Broad design standard 10 Design speed 11 Design Volume traffic characteristic		P1b Design approach 13 Geometry of Horizontal and Vertical Alignment 14 Typical Cross Sections 15 Effect of Cross Sectional Variation 16 Roadway Layout 17 Shoulders and edge treatment 18 Effect of Departure from Standards & guidelines		D1b Design approach 13 Geometry of Horizontal and Vertical Alignment 14 Typical Cross Sections 15 Effect of Cross Sectional Variation 16 Roadway Layout 17 Shoulders edge treatment 18 Effect of Departure from Standards & guidelines 19 Visibility sight distances 20 Signs and markings			
F2 Intersections 1 Number and Type of Intersections		P2 Local Alignment 1 Visibility 2 New/Existing Road Interface 3 Readability by drivers		D2 Local Alignment 1 Visibility 2 New/Existing Road Interface 3 Readability by drivers 4 Detailed Geometric Design 5 Treatment - bridges & culverts		O2 Local Alignment 1 Visibility sight distances 2 New/Existing Road Interface 3 Readability by drivers 5 Treatment at Bridges and Culverts	
F3 Environmental Constraints 1 Safety Aspects including weather natural features		P3 Intersections 1 Visibility 2 Layout including appropriateness of type 3 Readability by drivers		D3 Intersections 1 Visibility 2 Layout appropriateness 3 Readability by drivers 4 Detailed geometric design 5 Traffic signals 6 Roundabouts islands 7 Other intersections		O3 Intersections 1 Visibility 3 Readability by drivers 5 Traffic Signals 6 Roundabouts, islands	
F4 Any Matter not covered above 1 Safety aspects not already dealt with		P4 Non-vehicular provision 1 Adjacent Land 2 Pedestrians 3 Cyclists 4 Equestrians/stock		P4 Non-vehicular provision 1 Adjacent Land 2 Pedestrians 3 Cyclists 4 Equestrians/stock		O4 Non-vehicular provision 1 Adjacent Land 2 Pedestrians, incl refuges 3 Cyclists 4 Equestrians/stock	
		P5(6) Signs and Lighting 1 Lighting 2 Signs 3 Markers, edge delineation		D5 Signs and Lighting 1 Lighting 2 Signs 3 Markers edge delineation		O5 Signs and Lighting 1 Lighting 2 Signs visibility & position 3 Markers edge delineation	
				D6 Physical Objects (poles barriers etc) 1 Median barriers 2 Poles & other obstructions 3 Guardrailing 4 Bridge & culvert parapets		O6 Physical Objects (poles barriers etc) 1 Median Barriers 2 Poles& other obstructions 3 Guardrailing	
Note This stage is the only checklist not to conform with the standard sequential numbering and topic descriptions All subsequent safety audit checklists have a standard format and text		P7 Construction and Operation 1 Buildability 2 Operation 3 Traffic Management 4 Network Management 5 By - law requirements		D7 Construction and Operation 1 Buildability 2 Operation 3 Traffic Management 4 Network Management 5 Temporary traffic control / management		O7 Construction and Operation 2 Operation 3 Traffic Management in practice 6 Temporary Traffic Control/management, change to permanent	
The narrow columns are for the use of Safety Auditors in any way they see fit		P8 Any other matter 1 Safety aspects not already covered		D8 Any other matter 1 Safety aspects not already coverec		O8 Any other matter 1 Safety matters not already covered	

FREQUENCY OF REFERENCE TO TOPICS IN "PROBLEMS"